



11 T Task Force Meeting Coil Size and Rigidity

S. Izquierdo Bermudez, M. Daly, S. Ferradas Troitino, P. Grosclaude, M. Guinchard, C. Hannes Loffler, J. L. Rudeiros Fernandez, P. Ferracin, A. Carlon Zurita, P. Ferracin, J. C. Perez
7th February 2018



11 T task force meeting #8

Overview

- Ten-stacks
 - Insulation thickness
 - Measurements on ten stacks for coils 118, 119, 120 and 122 done
 - E-modulus measurements
 - 2 ten stacks, RPP 108-127 “old insulation” finished
 - 2 ten stacks, RPP 108-127 “new insulation” finished
 - Next step: cut and define the measuring sequence
- Faro arm
 - Measurements on CR003 spare segments and 1st segments done
 - Next step: measure segments for 2nd and 3th mock up as soon as they are available.
 - Measurements of coils on MBHDP102 after cold test on-going
- E-modulus press
 - Study of impact of cyclic loading on coils done
 - Measurements on stress distribution on the mid-plane with Fuji done, analysis on-going
 - Next step: measured CR003 coil segments as soon as they are available.

Insulation thickness – Ten stack measurements

Coil 118

Sample	Insulation thk. At 5 MPa [μm]
S1	95
S2	100
S3	107

Coil 119

Sample	Insulation thk. At 5 MPa [μm]
S1	104
S2	107
S3	108

Coil 120

Sample	Insulation thk. At 5MPa [μm]
S1	104
S2	104
S3	106

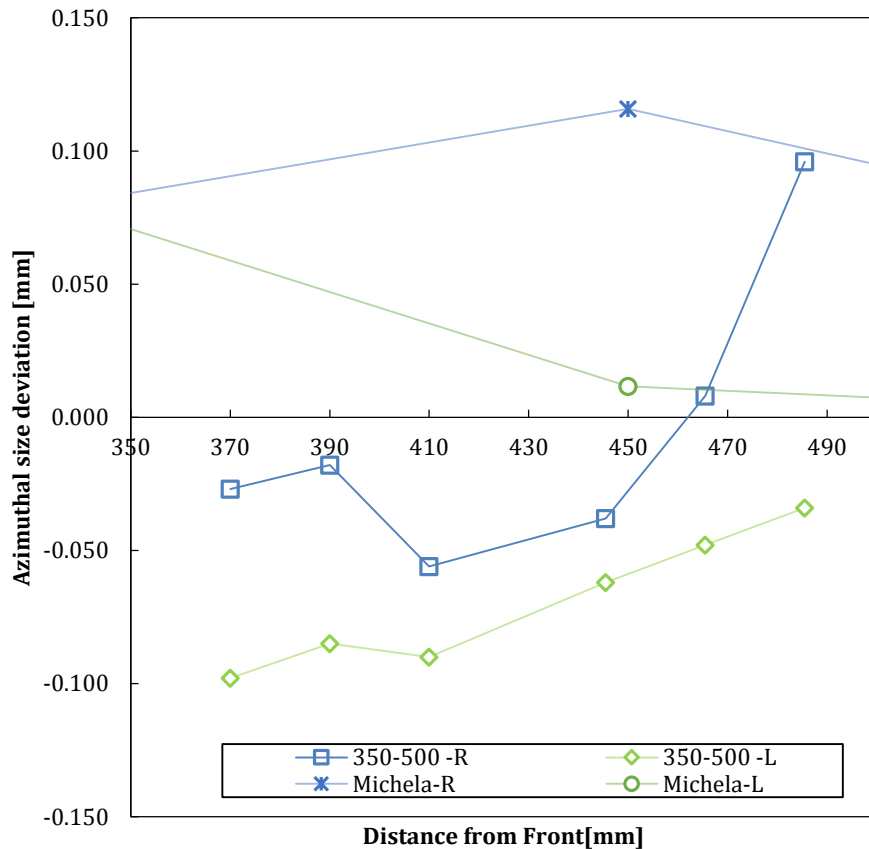
Coil 122

Sample	Insulation thk. At 5 MPa [μm]
S1	106
S2	107
S3	107

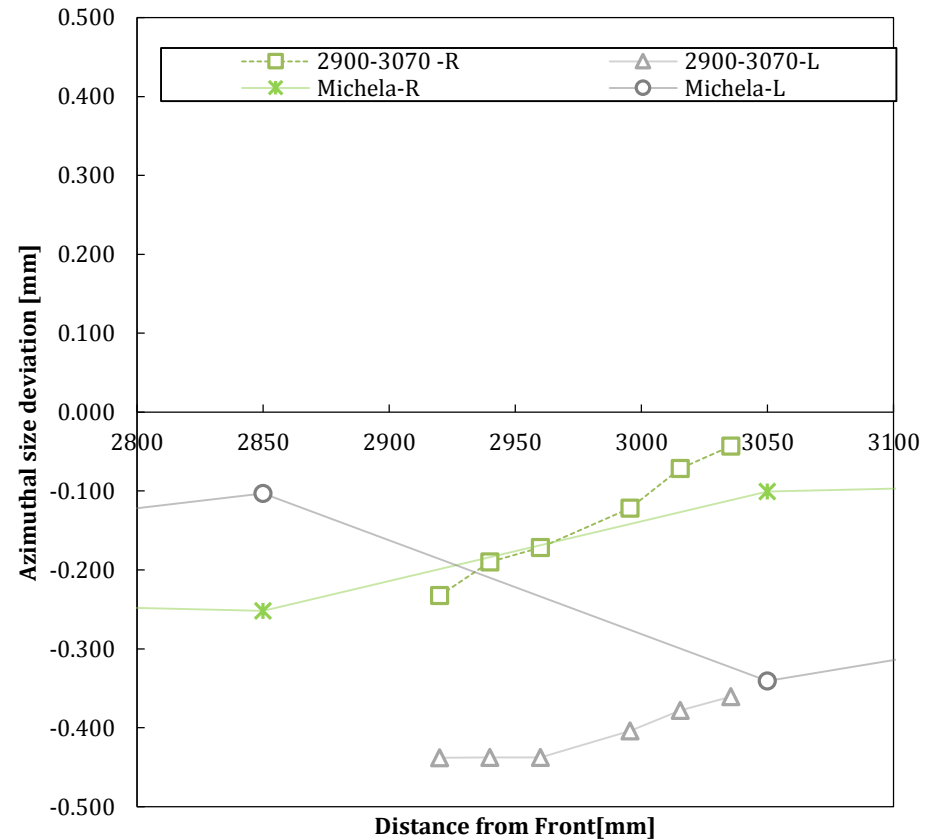
Faro Arm Measurements – CR03

- Spare segments

CR003 Quadrants

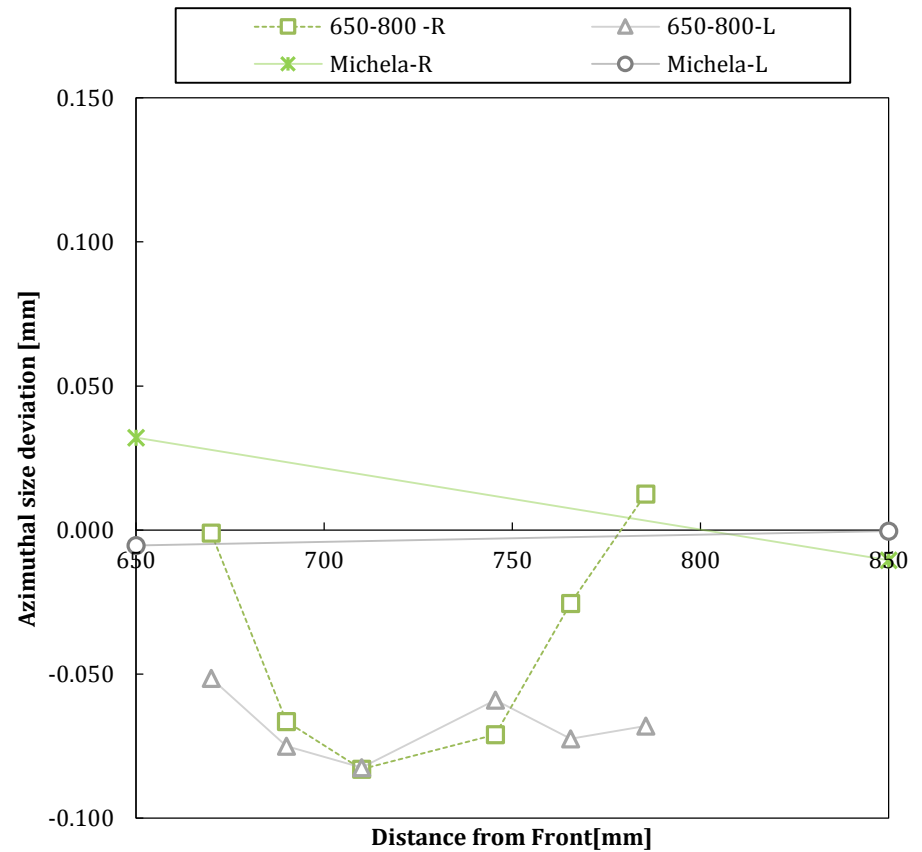
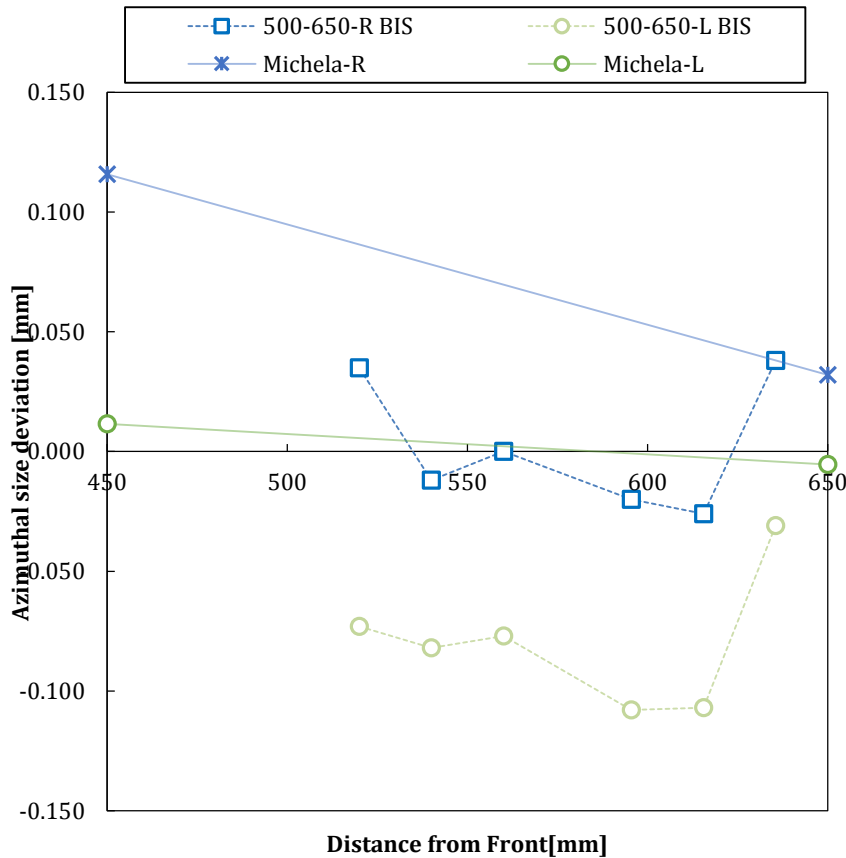


CR003 Quadrants



Faro Arm Measurements – CR03

- Segments for the 1st collaring mock up



POSITIVE MEANS SMALLER

Faro Arm Measurements - Summary

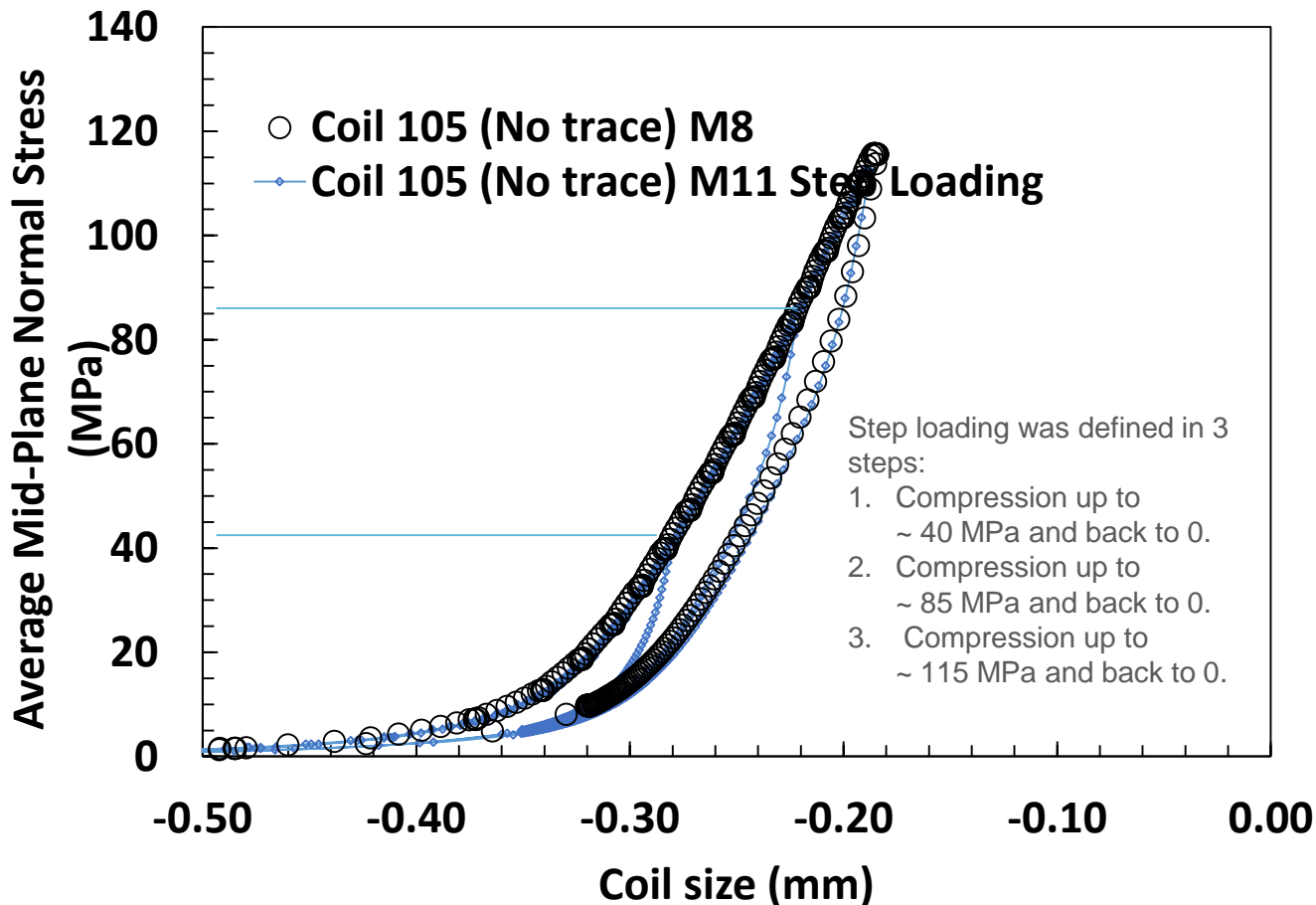
- Significant difference with respect to faro arm measurements in 180 before cutting the coil which needs to be understood.

Spare segment	Average azimuthal size [mm] 927 measurements	Average azimuthal size [mm] 180 measurements	Difference [mm]
350-500-R	-0.006	0.116	0.122
350-500-L	-0.070	0.011	0.081
2900-3070-R	-0.147	-0.175	-0.029
2900-3070-L	-0.396	-0.222	0.174

1st collaring mock up	Average azimuthal size [mm] 927 measurements	Average azimuthal size [mm] 180 measurements	Difference [mm]
500-650-R	0.032	0.074	0.042
500-650-L	-0.092	0.003	0.095
650-800-R	-0.028	0.011	0.039
650-800-L	-0.078	-0.003	0.075

Single Step Loading vs. Multiple Steps Loading

- No difference on single step loading vs. multiple steps loading for a coil after cold powering test
 - Is it also the case for a virgin coil?

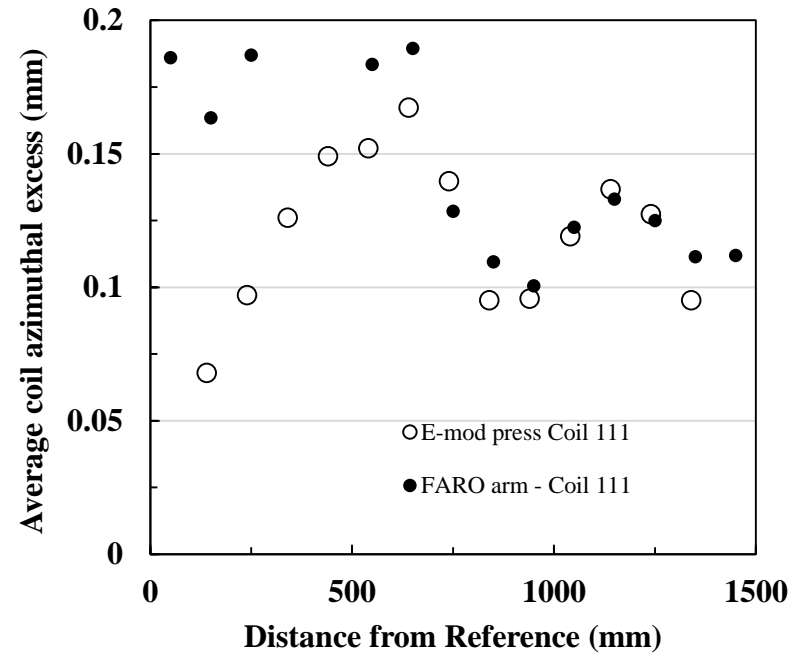
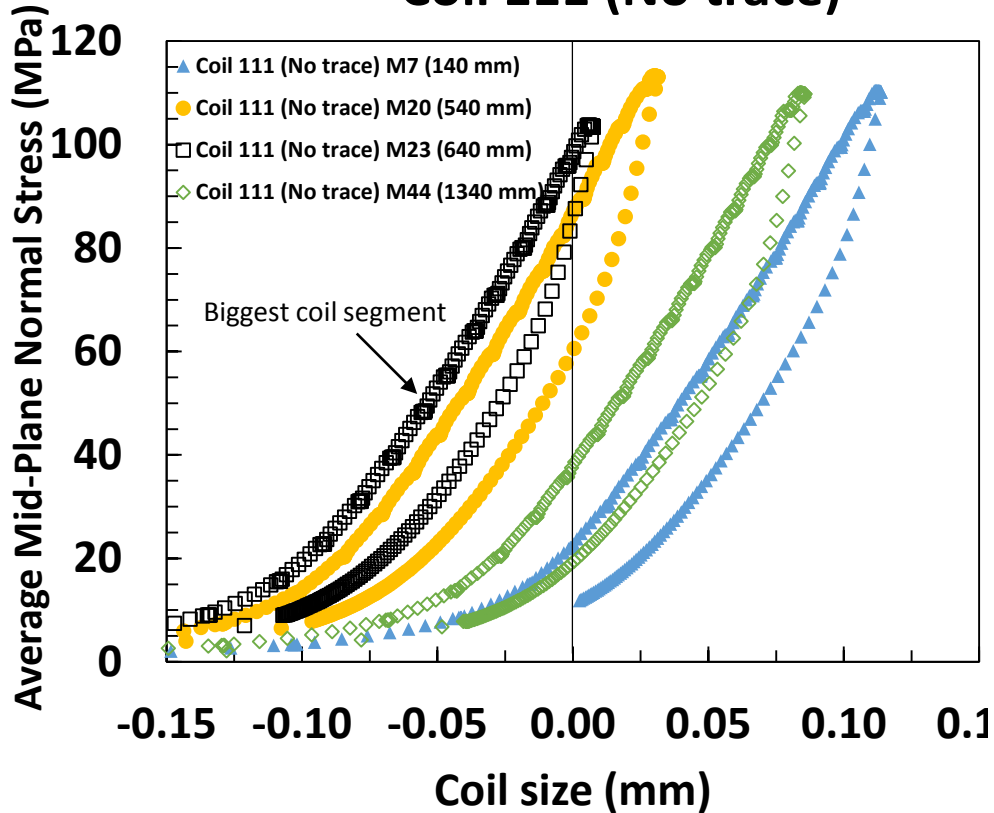


“Coil size 0” represents the nominal size of the calibration steel block at 5 MPa.

Positive mid-plane displacement corresponds to compression of the coil.

Coil stiffness

Coil 111 (No trace)



“Coil size 0” represents the nominal size of the calibration steel block at 5 MPa. Positive mid-plane displacement corresponds to compression of the coil.

Coil stiffness – Difference among coils

	Magnet	Strand lay out	cu/sc	Coil R at 300 K mΩ	Glass heater-coil mm	Azimuthal oversize*		Interlayer Quench Heater	End Saddles	Wedges Type	End Spacers	Impregnation	E-modulus** [GPa]	
						L, mm	R, mm						w.o. trace	w. trace
Coil 105	MBHSM101	RRP 108/127	1.22	426	0.1	-0.282	-0.319	no	SLS 316LN	ODS Cu 2 segments	SLS 316LN		35	34
Coil 106	MBHSP101	RRP 108/127	1.22	423	0	-0.059	-0.138	no	G11	ODS Cu 2 segments	SLS 316LN		36	
	MBHSP102													
	MBHDP101													
Coil 107	MBHSP101	RRP 108/127	1.22	426	0.1	-0.053	-0.105	no	G11	ODS Cu 2 segments	SLS 316LN			
Coil 108	MBHSP102	RRP 132/169	1.22	407	0.1	-0.076	-0.040	no	G11	ODS Cu 2 segments	SLS 316LN		33	32
	MBHDP101													
Coil 109	MBHSP103	RRP 132/169	1.27	400	0	-0.041	-0.085	no	G11	ODS Cu 2 segments	SLS 316LN			
	MBHDP101													
	MBHDP102 (ap SP104b)													
Coil 111	MBHSP103	RRP 132/169	1.27	401	0.1	-0.216	-0.171	no	G11	ODS Cu 2 segments	SLS 316LN		39	
	MBHDP101													
Coil 112	MBHSP104	RRP 132/169	1.27	403	0.08	-0.148	-0.141	no	G11	ODS Cu full length	SLS 316LN			
	MBHDP102 (ap SP104b)													
Coil 113	MBHSP104	RRP 132/169	1.27	403	0.08	-0.053	-0.258	no	G11	ODS Cu full length	SLS 316LN			39
Coil 114	MBHSP105	RRP 150/169	0.98	432	0 (heaters imprg)	-0.108	-0.222	no	G11	ODS Cu full length	SLS 316LN			
	MBHDP102 (ap SP105b)													
Coil 115	MBHSP105	RRP 150/169	0.97	436	0 (heaters imprg)	-0.097	-0.174	no	G11	ODS Cu full length	SLS 316LN			
	MBHDP102 (ap SP105b)													
Coil 116	MBHSP106	RRP 150/169	0.97	449	0 (heaters imprg)	-0.191	-0.094	yes	G11	ODS Cu full length	SLS 316LN			
Coil 117	MBHSP106	RRP 150/169	0.97	450	0 (heaters imprg)	-0.096	-0.136	yes	G11	ODS Cu full length	SLS 316LN coated	With pressure		
Coil 110	Test coil	RRP 132/169			0 (heaters imprg)	-0.274	-0.303	yes	G11	ODS Cu full length	SLS 316LN	With pressure		
Coil 201	Test coil	PIT			0 (heaters imprg)	-0.096	-0.136	tes	G11	ODS Cu full length				

- If after full inspection of coils in MBHDP102 (109,112,114,115), some segments are available, we are willing to measure them to have more statistics.
- If there is not plan for coil 201 (virgin), we are also willing to measure (I would do electrical checks to the limit first)

*Negative means bigger than nominal

** Equivalent stiffness based on a straight line fitted to the data between 60 and 80 MPa during the loading phase by the method of least squares. (Boundary conditions considered as $\mu = 0.2$)